BAG-raising in Ontario and Colorado

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Canadä

Introduction

- Pre-velar $/ \infty /$ -raising $(/ \infty / \rightarrow \text{raised } / _g)$ occurs in some regions of North America, including Canada, Pacific Northwest, Upper Midwest (Stanley 2018b, 2019)
- Anecdotal evidence suggests there is variation in the perception of this contrast
- Are there differences in perception, and if so, what contributes to these differences?

What is pre-velar /æ/-raising (BAG-raising)?

• Process whereby some North American English speakers raise /æ/ before /g/ (but not /k/) (e.g. in *bag*, but not in *back*)

$$/æ/\rightarrow$$
 raised $/_g$

- Raising doesn't necessarily change phonological category for speakers who participate in raising
- Acoustically, a raised /æ/ has a lower F1 (& higher F2) than an unraised /æ/

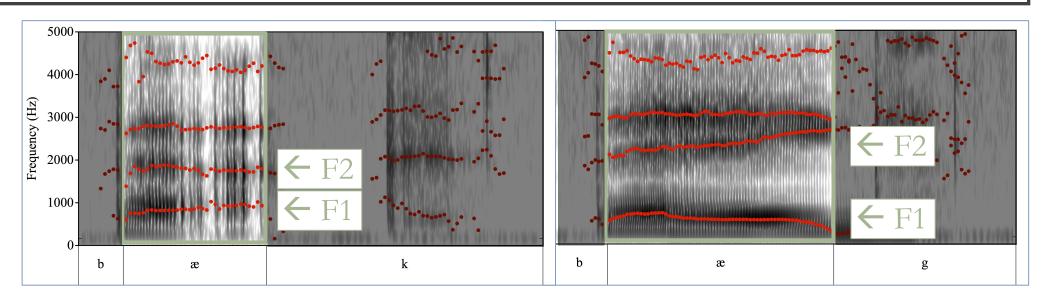
Spectrograms of a raiser & a non-raiser

Raiser (CAN F 30)





bag

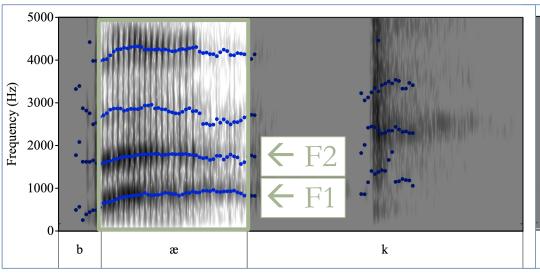


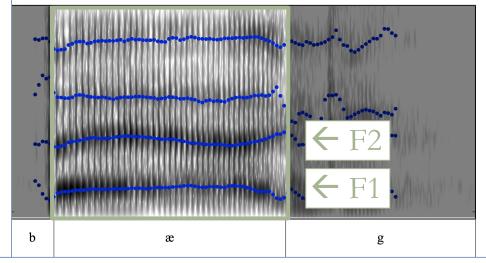
Non-Raiser (US M 27)





bag

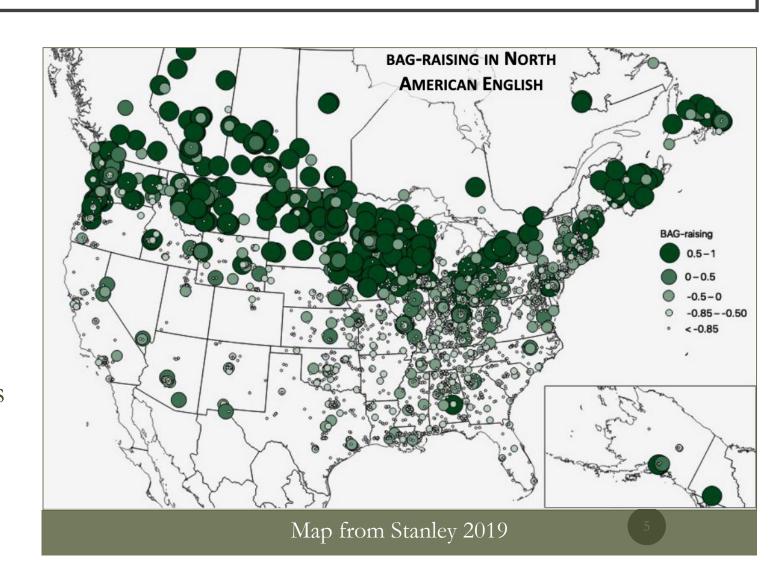




Where does BAG-raising occur?

Self-Report Study (Stanley 2018b; 2019)

- Asked participants how they think they pronounce /æg/ in various words
- Canada & parts of the US closer to the Canadian border
- Prevalence of /æ/-raising decreases as you go further south in the US



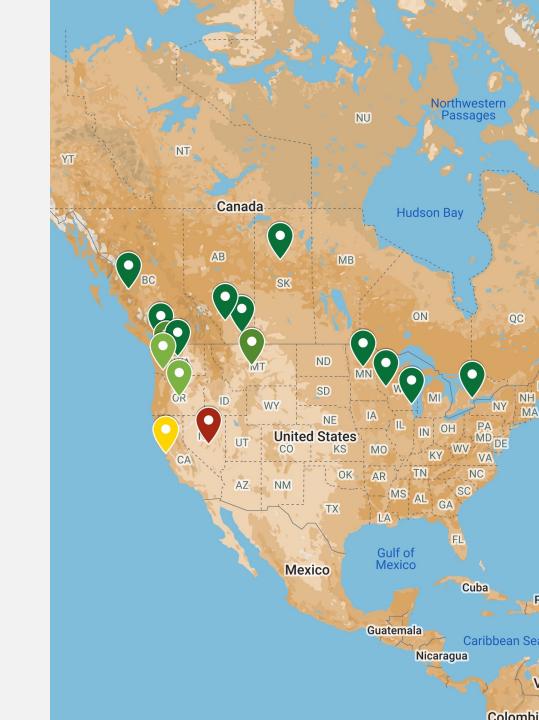
Where does BAG-raising occur?

Acoustic Studies

Raising documented in:

- Canada: across the country, including
 Vancouver, BC, Calgary, southern Alberta,
 Toronto
- **US**: Pacific Northwest (Washington, Oregon, Montana), Upper Midwest (Minnesota, Wisconsin)

No raising or inconclusive results: Nevada, California



Perception – Effects of production & phonological context

Freeman (2015, 2019): Cross-modal word completion task with participants from the Pacific Northwest

No effect of phonological context (_d vs _g)

No effect of production

Sullivan (2020a,b): 2 alternative forced choice task with participants from the US and Canada

Effect of phonological context (_k vs _g)

No effect of production

Anecdotal evidence for variation in perception

- Americans living in Toronto say Canadian b[æ]g sounds like b[e]g or b[ε]g → Americans hear raised /æ/ as a mid vowel
- As a speaker of Canadian English, I wasn't aware of pre-velar /æ/-raising until Americans told me about it → I (Canadian) hear raised /æ/ as a low vowel
- American participants in Sullivan (2020a,b) commented on pre-velar /æ/ raising as "that thing you Canadians do" → Americans hear raise /æ/ as distinct from unraised /æ/
- Canadian participants had to be explicitly told to compare bag to back to hear the difference →
 Canadians don't hear raised /æ/ as distinct from unraised /æ/

Dissertation Goals

- Substantiate anecdotal evidence on differences in perception/ metalinguistic awareness of pre-velar /æ/-raising
- Document the production of pre-velar /æ/-raising in Ontario and Colorado
- Explore how pre-velar $/\infty$ -raising is perceived and the relationship of production, phonological context and metalinguistic awareness to perception

Main Research Question

Do listeners perceive raised and unraised /æ/ as distinct pronunciations?

- Does this vary in relation to their production?
- Does this vary in relation to their metalinguistic awareness?
- Does this vary in relation to phonological context?



PREDICTIONS

There will be variation in the perception of /æ/-raising

- **Production**: Production will be inversely correlated with perception. The more someone raises in production, the less they will distinguish raise and unraised /æ/ in perception
- Metalinguistic Awareness: Listeners with more metalinguistic awareness will distinguish raised and unraised /æ/ better than those with less metalinguistic awareness
- **Phonological Context**: All listeners should distinguish raised and unraised /æ/ before /k/, but only some before /g/

Three Experiments

- Metalinguistic Awareness Survey: Substantiate anecdotal evidence for variation in the perception of $/\infty$ -raising & explore its to do social work
- **Production Study:** Document the production of /æ/-raising in Ontario and Colorado
- Perception Study: Explore how pre-velar /x-raising is perceived and the relationship of production, phonological context and metalinguistic awareness to perception

Outline

- 1. Introduction
- 2. Metalinguistic Awareness
- 3. Production
- 4. Perception
- 5. Conclusion

Research Questions

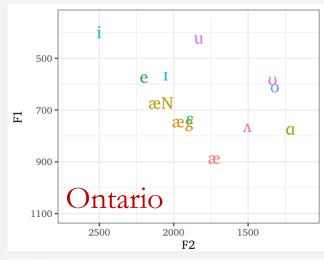
Do native English speakers from Colorado and Ontario BAG-raise?

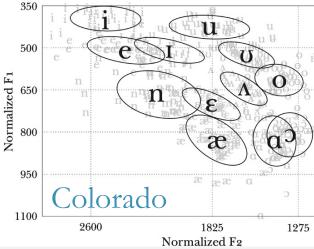
- Does degree of raising vary by participant?
- Does degree of raising vary by gender?



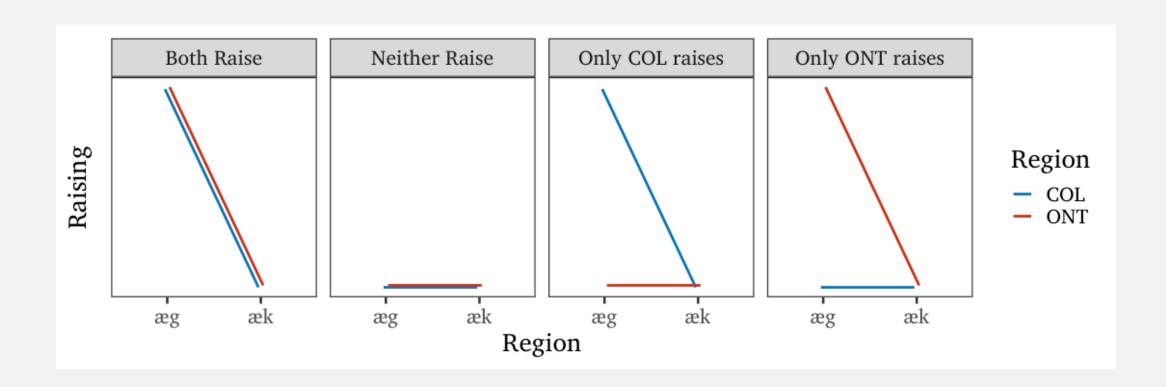
Why Ontario and Colorado?

- 1. Ontario and Colorado appear to have similar vowel spaces due to California/Canadian vowel shift (setting aside Canadian raising) (Boberg, 2010; Holland & Bradenburg, 2017)
- 2. We expect to see BAG-raising in Ontario based on previous studies (Boberg, 2008; Sullivan, 2020), but not Colorado (Holland & Bradenburg, 2017), though only documented in self-report data there (Stanley, 2018; 2019)





Hypotheses



METHOD

Participants

			Age		Town/City Population		
Region	Gender	n	M	Range	1k-30k	30k-100k	>100k
ONT	F	14	25.9	19–32	2	5	7
	M	12	23.0	19–29	1	1	10
	Total	26	24.5	19–32	3	6	17
COL	F	15	23.9	19–35	2	8	5
	M	9	26.0	19–31	2	4	3
	Total	24	24.5	19–35	4	12	8
Total	F	29	24.9	19–35	4	13	12
	M	21	24.3	19–31	3	5	13
	Total	50	24.6	19–35	7	18	25

Stimuli: Target Words

Initial Consonant	/eg/	/ek/	/eg/	/εk/	/æg/	/æk/
1	plague	lake	leg	fleck	lag	lack
v/b	vague	bake	beg	beck	bag	back
n		snake	neg	neck	nag	knack
t/Ø		take	egg	tech	tag	tack
Total (22)	2	4	4	4	4	4

Stimuli: Vowel **Space Words**

• Total Vowel Space
Words: 22 (11 vowels *
2 environments)

• Fillers: 16 words

Vowel	/b_d/	/b_t/	
i	bead	beat	
I	bid	bot	
e	bade	bait	
ε	bed	bet	
æ	bad	bat	
u	booed	boot	
О	bode	boat	
Λ	bud	but	
С	bawd	bought	
a	bod	bot	
σ	hood	put	

Preliminary Tasks

- Consent
- Instructions
- Microphone Check: Participants record themselves and play the recording back to check that their mic is working

Production Task

- 3 reps of word list, randomized each time
- Participants have 10 seconds to say each word
- Once they are done speaking they click done to end the recording & proceed to the next trial

Other Tasks

- Language Background Questionnaire
- Perception
- Metalinguistic Awareness
- etc.

Acoustic Analysis

- Segment using the Montreal Forced Aligner (McAuliffe et al., 2017)
- Manually correct annotation and do exclusions in Praat (Boersma & Weenink, 2021)
- Exclusions include: speech errors, incomplete recordings, noisy recordings, formant tracking errors
- Extract F1, F2 at vowel midpoint
- Convert F1 and F2 to Bark and z-score normalize

Normalization

01

Calculate the mean F1 and F2 for each vowel space word

02

Use these means to calculate mean and standard deviation

• Avoids target words or different number of tokens for each vowel space word skewing the data

03

Use this mean and standard deviation to calculate z-scores

Response Variable

- F1
- F2

Predictor Variables

- Phonological context (pre-/g/ or pre-/k/)
- Region (Ontario or Colorado)
- Gender (female or male)

Random Effects

- Intercepts: Participant, Item
- Slopes: Final Consonant by Participant

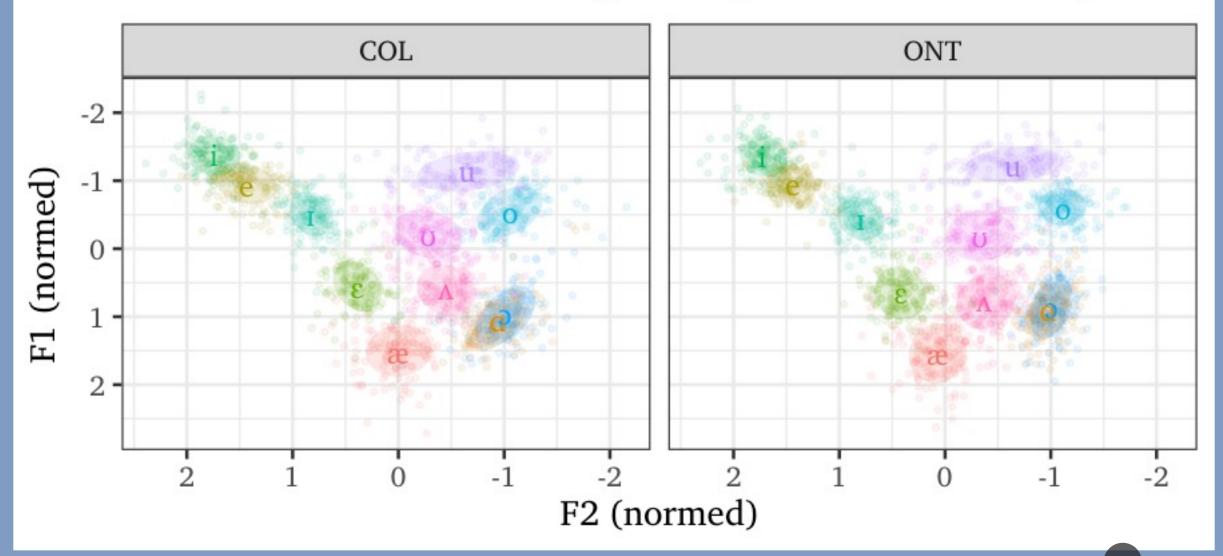
Individual Differences

- /ek/ and /æk/ tend to be consistent across speakers and /æg/ tends to fall between them
- F1 is the primary cue to raising, so measure is for F1
- Degree of raising is the proportion of the distance between /ek/ and /æk/

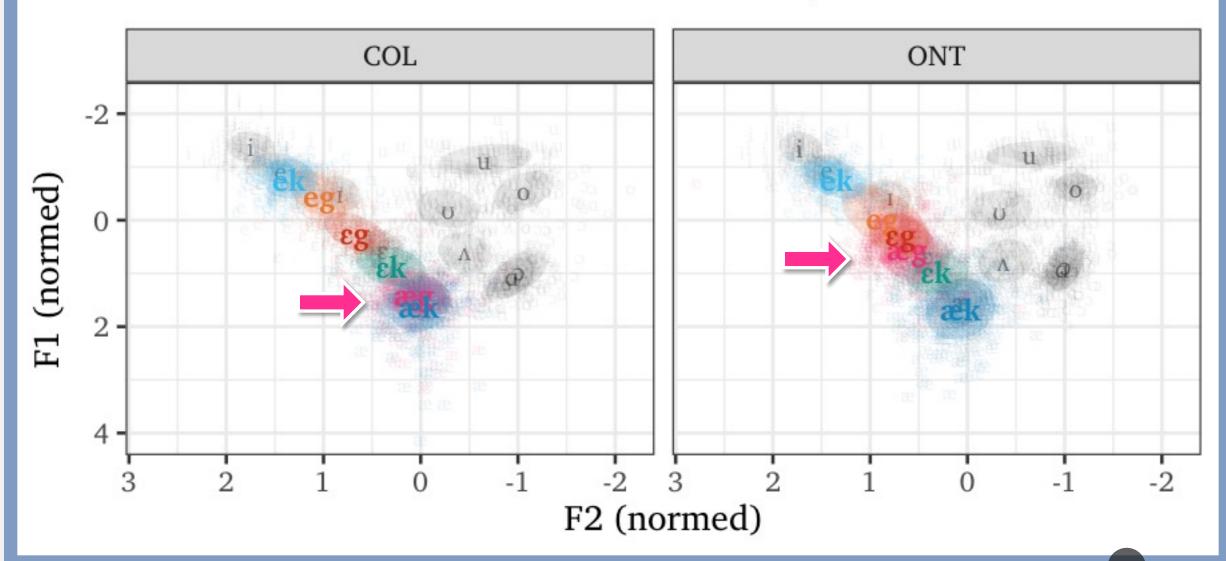
$$\frac{M_{\rm æk}-M_{\rm æg}}{M_{\rm æk}-M_{\rm ek}}$$

RESULTS

Colorado & Ontario English Speakers' Vowel Spaces

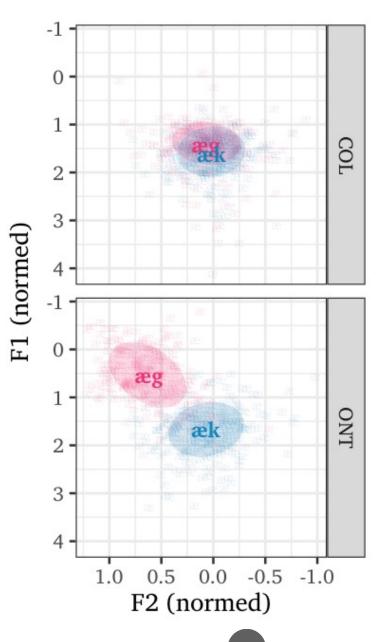


Production of Prevelar /æ/, /ε/ and /e/



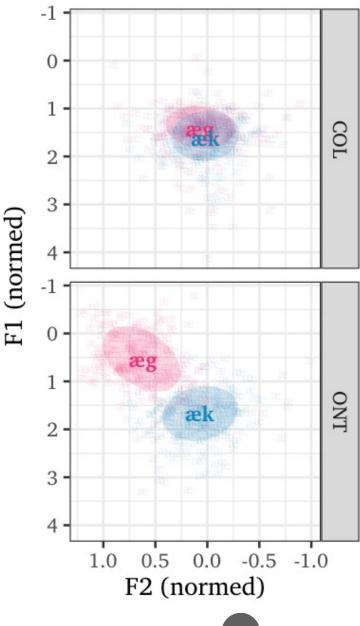
Results – F1

- Phonological Context: more raised before /g/ than /k/
- **Region**: more raised for ONT than COL
- Phonological Context
 * Region: Ontarians
 raise more than
 Coloradans





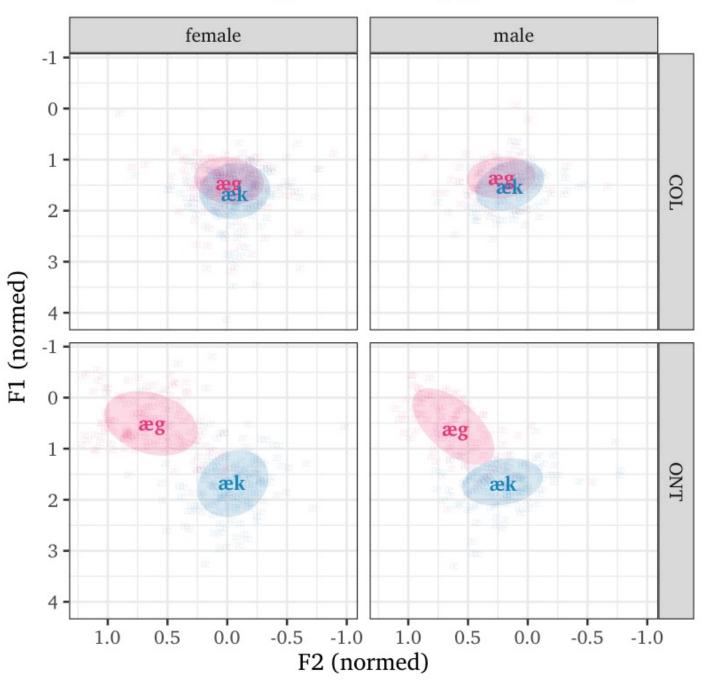
- **Phonological Context**: fronter before /g/
- **Region**: fronter in ONT
- Phonological Context *
 Region: Fronter before
 /g/, but not /k/ in ONT
- **Gender**: fronter for M
- Phonological Context *
 Region * Gender: Main
 effect of gender in COL
 (M are fronter); Interacts
 with final consonant for
 ONT (Larger difference
 between contexts for F)



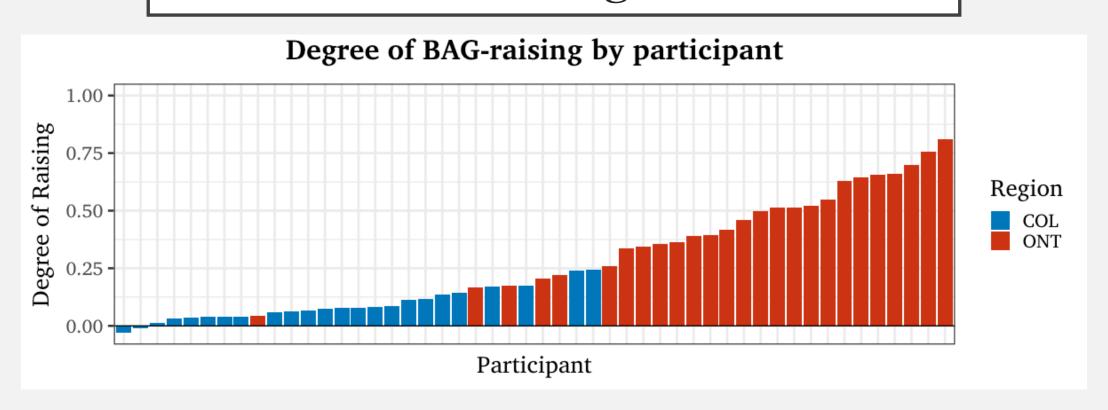
Gender Difference & /æ/-retraction

- In both regions, females display more
 /æ/ retraction than males
- In Ontario, the position of /æg/ is similar for males and females, but the position of /æk/ is different
- The gender effect may be due to degree of /æ/-retraction and not degree of BAG-raising

Production of /æg/ & /æk/ by gender & region



Individual Degree of BAGraising

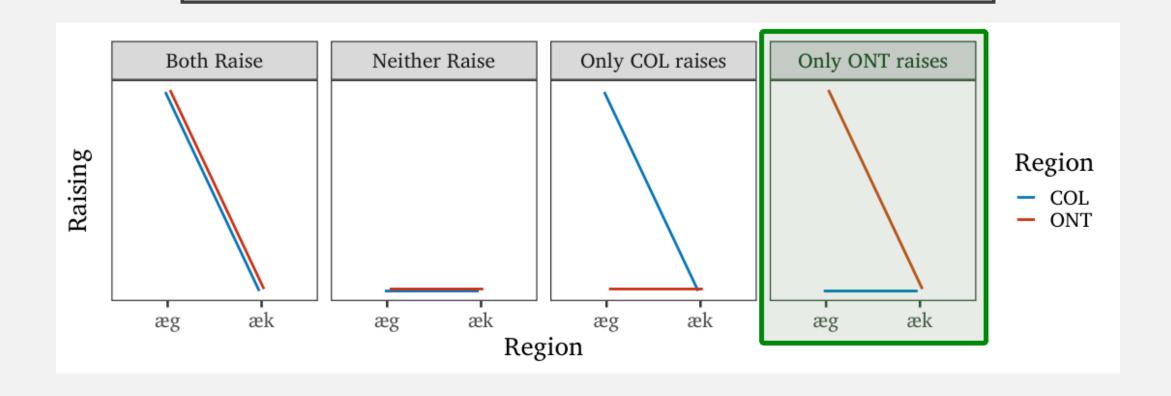


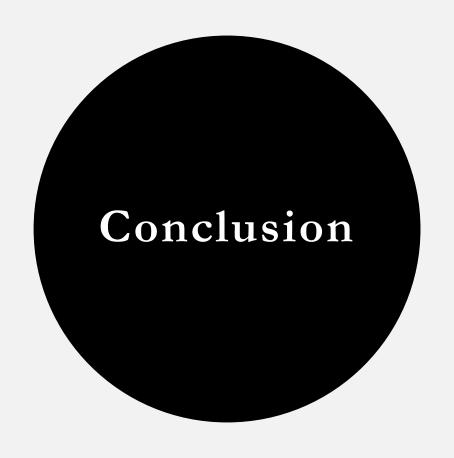
CONCLUSION

Summary of Results

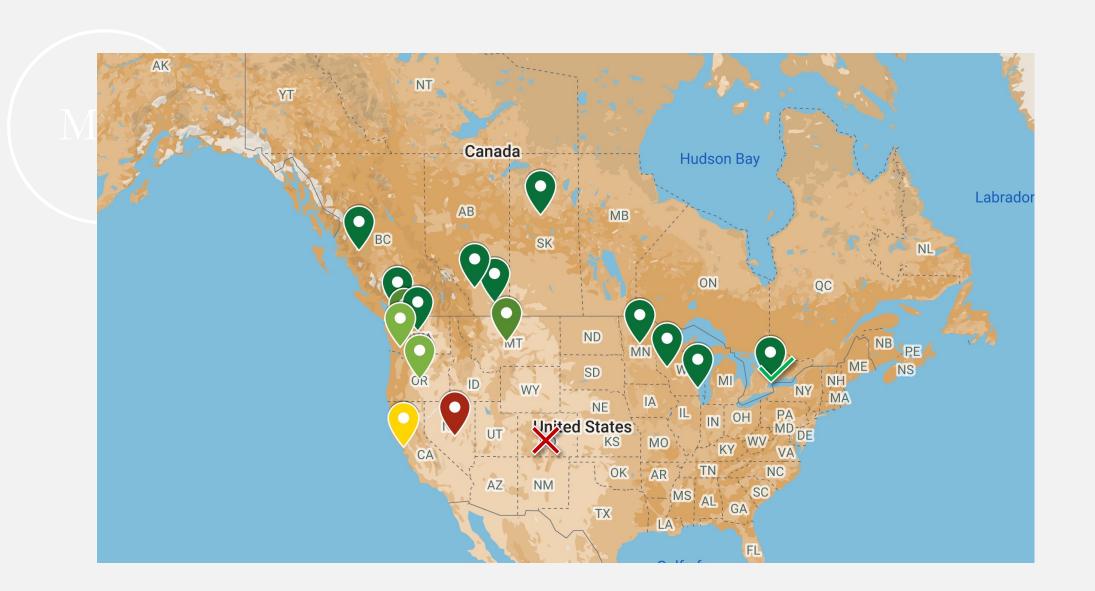
- Ontario participants BAG-raise more before /g/ than Colorado participants
- $/\alpha$ / does not appear to be raised before /k/
- There is a gender difference, but this could be due to more advanced /æ/-retraction by females rather than BAG-raising
- There is variation across individuals, but most Ontarians raise more than most Coloradans

Hypotheses





- Do Coloradans and Ontarians BAG-raise?
 - Coloradans do not BAG-raise (or not much)
 - Ontarians do BAG-raise
- Does degree of BAG-raising vary by participant?
 - Yes, but Ontarians tend to raise more than Coloradans
- Does degree of BAG-raising vary by gender?
 - Probably not



Some thoughts on online production data collection

- Participants were required to use computers and data quality was generally good
- Very few participants were excluded due to poor quality recordings or background noise
- Most exclusions were due to participants moving to the next trial before they finished speaking, which led to recordings being cut off
- In future, perhaps prevent participants from proceeding to the next trial for a couple seconds to mitigate this problem

Thank you!

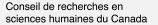
Jessamyn Schertz, Nathan Sanders, Derek Denis, Yoonjung Kang, Marisa Brook, Beth MacLeod

Na-Young Ryu, Patrick Murphy, Hyoung Seok Kwon

Simon Whedbee, Anthony Fredette, Brian Sullivan, Cheryl Sullivan, Brianna Sullivan, Patrick Sullivan, Philip Sullivan

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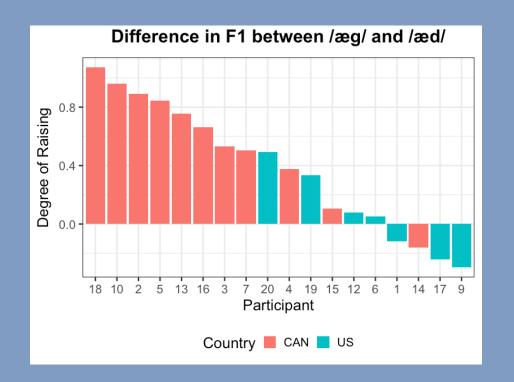
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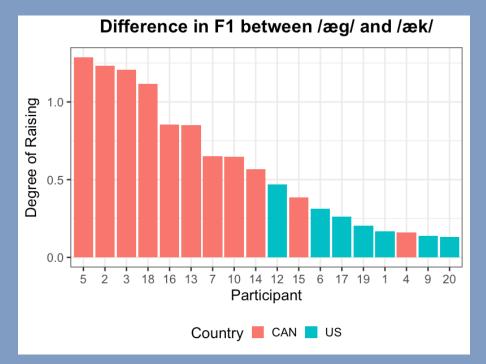
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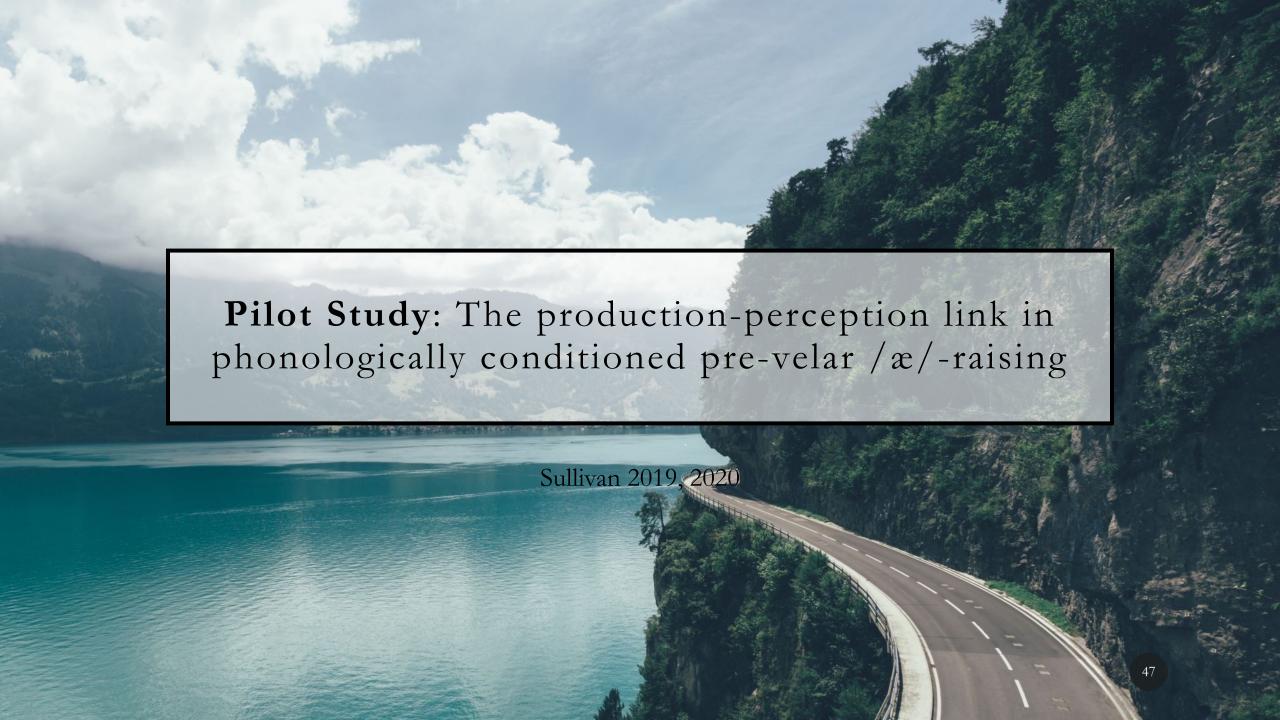
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DEGREE OF RAISING RELATIVE TO _K & _D



Questions

1

Is variation in the perception of /æ/-raising perception conditioned by individual production?

2

Is variation in the perception of /æ/-raising conditioned by regional dialect?

3

Is variation in the perception of /æ/-raising phonologically conditioned?

Method



Participants: Canadians (raisers) and Americans (non-raisers) living in Toronto for at least 1 year (same exposure)



Production Task: Word list reading task



Perception Task: Forced choice word discrimination task

Production by region

- /æg/ is higher for Canadians than Americans
- Suggests (these) Canadians participate in /æ/-raising, but (these) Americans do not

Production of /æ/ and /ε/ before /g/ and /k/ by Canadian (CAN) and American (US) speakers

